

DS14C88/DS14C88T QUAD CMOS Line Driver

General Description

The DS14C88 and DS14C88T, pin-for-pin compatible to the DS1488/MC1488, are line drivers designed to interface data terminal equipment (DTE) with data circuit-terminating equipment (DCE). These devices translate standard TTL/CMOS logic levels to levels conforming to EIA-232-D and CCITT V.28 standards.

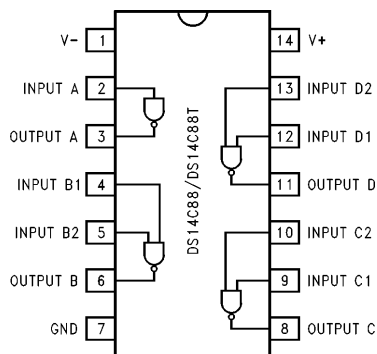
The device is fabricated in low threshold CMOS metal gate technology. The device provides very low power consumption compared to its bipolar equivalents: 500 μ A (DS14C88) versus 25 mA (DS1488).

The DS14C88/DS14C88T simplifies designs by eliminating the need for external slew rate control capacitors. Slew rate control in accordance with EIA-232D is provided on-chip, eliminating the output capacitors.

Features

- Meets EIA-232D and CCITT V.28 standards
- Industrial temperature range
–40°C to +85°C—DS14C88T
- LOW power consumption
- Wide power supply range
 ± 5 V to ± 12 V
- Available in SOIC package

Connection Diagram



TL/F/11105-1

Order Number DS14C88N, DS14C88M, DS14C88TJ, DS14C88TN or DS14C88TM
See NS Package Number J14A, N14A or M14A

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	
V ⁺ Pin	+13V
V ⁻ Pin	-13V
Driver Input Voltage	(V ⁺) + 0.3V to GND -0.3V
Driver Output Voltage	$ V^{+} - V_O \leq 30V$ $ V^{-} - V_O \leq 30V$
Continuous Power Dissipation @ +25°C (Note 2)	
N Package	1513 mW
J Package	1935 mW
M Package	1063 mW
Junction Temperature	+150°C

Lead Temperature
(Soldering 4 seconds) +260°C
Storage Temperature Range -65°C to +150°C

This Product does not meet 2000V ESD rating. (Note 9)

Recommended Operating Conditions

	Min	Max	Units
V ⁺ Supply (GND = 0V)	+4.5	+12.6	V
V ⁻ Supply (GND = 0V)	-4.5	-12.6	V
Operating Free Air Temp. (T _A)			
DS14C88	0	+75	°C
DS14C88T	-40	+85	°C

Electrical Characteristics Over Recommended Operating Conditions, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I _{IL}	Maximum Low Input Current	V _{IN} = GND			+10	μA
I _{IH}	Maximum High Input Current	V _{IN} = V ⁺	-10			μA
V _{IL}	Low Level Input Voltage	V ⁺ ≥ +7V, V ⁻ ≤ -7V	GND		0.8	V
		V ⁺ < +7V, V ⁻ > -7V	GND		0.6	V
V _{IH}	High Level Input Voltage		2.0		V ⁺	V
V _{OL}	Low Level Output Level	V _{IN} = V _{IH} R _L = 3 kΩ or 7 kΩ	V ⁺ = 4.5V, V ⁻ = -4.5V	-4.0	-3.0	V
			V ⁺ = 9V, V ⁻ = 9V	-8.0	-6.5	V
			V ⁺ = 12V, V ⁻ = -12V	-10.5	-9.0	V
V _{OH}	High Level Output Level	V _{IN} = V _{IL} R _L = 3 kΩ or 7 kΩ	V ⁺ = 4.5V, V ⁻ = -4.5V	3.0	4.0	V
			V ⁺ = 9V, V ⁻ = -9V	6.5	8.0	V
			V ⁺ = 12V, V ⁻ = -12V	9.0	10.5	V
I _{OS+}	High Level Output Short Circuit Current (Note 3)	V _{IN} = 0.8V, V _O = GND	V ⁺ = +12V, V ⁻ = -12V	-45		mA
I _{OS-}	Low Level Output Short Circuit Current (Note 3)	V _{IN} = 2.0V, V _O = GND			+45	mA
R _{OUT}	Output Resistance	V ⁺ = V ⁻ = GND = 0V -2V ≤ V _O ≤ +2V (Note 4) (Figure 1)	300			Ω
I _{CC+}	Positive Supply Current	V _{IN} = V _{ILmax} R _L = OPEN	V ⁺ = 4.5V, V ⁻ = -4.5V		10	μA
			V ⁺ = 9V, V ⁻ = -9V		30	μA
			V ⁺ = 12V, V ⁻ = -12V		60	μA
		V _{IN} = V _{IHmin} R _L = OPEN	V ⁺ = 4.5V, V ⁻ = -4.5V		50	μA
			V ⁺ = 9V, V ⁻ = -9V	DS14C88	300	μA
				DS14C88T	400	μA
			V ⁺ = 12V, V ⁻ = -12V	DS14C88	500	μA
				DS14C88T	700	μA
I _{CC-}	Negative Supply Current	V _{IN} = V _{ILmax} R _L = OPEN	V ⁺ = 4.5V, V ⁻ = -4.5V	DS14C88	-10	μA
				DS14C88T	-15	μA
			V ⁺ = 9V, V ⁻ = -9V	DS14C88	-10	μA
				DS14C88T	-15	μA
			V ⁺ = 12V, V ⁻ = -12V	DS14C88	-10	μA
				DS14C88T	-15	μA
		V _{IN} = V _{IHmin} R _L = OPEN	V ⁺ = 4.5V, V ⁻ = -4.5V	DS14C88	-30	μA
				DS14C88T	-45	μA
			V ⁺ = 9V, V ⁻ = -9V	DS14C88	-30	μA
				DS14C88T	-45	μA
			V ⁺ = 12V, V ⁻ = -12V	DS14C88	-60	μA
				DS14C88T	-80	μA

Switching Characteristics

Over Recommended Operating Conditions, unless otherwise specified (*Figures 2 and 3*) (Notes 5 and 6)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PLH}	Propagation Delay Low to High	$V^+ = +4.5V, V^- = -4.5V$		1.5	6.0	μs
		$V^+ = +9.0V, V^- = -9.0V$		1.2	5.0	μs
		$V^+ = +12V, V^- = -12V$		1.2	4.0	μs
t_{PHL}	Propagation Delay High to Low	$V^+ = +4.5V, V^- = -4.5V$		1.5	6.0	μs
		$V^+ = +9.0V, V^- = -9.0V$		1.35	5.0	μs
		$V^+ = +12V, V^- = -12V$		1.3	4.0	μs
t_r	Rise Time (Note 7)		0.2	1.0		μs
t_f	Fall Time (Note 7)		0.2	1.0		μs
tsk	Typical Propagation Delay Skew	$V^+ = +4.5V, V^- = -4.5V$		250		ns
		$V^+ = +9.0V, V^- = -9.0V$		200		ns
		$V^+ = +12V, V^- = -12V$		150		ns
S_R	Output Slew Rate (Note 7)	$R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ $C_L = 15\text{ pF}$ to 2500 pF			30	$V/\mu s$

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" specify conditions for device operation.

Note 2: Derate N Package 12.1 mW/°C, J Package 12.9 mW/°C, and M Package 8.5 mW/°C above +25°C.

Note 3: I_{OS+} and I_{OS-} values are for one output at a time. If more than one output is shorted simultaneously, the device dissipation may be exceeded.

Note 4: Power supply (V^+ , V^-) and GND pins are connected to ground for the Output Resistance Test (R_O).

Note 5: AC input test waveforms for test purposes: $t_r = t_f \leq 20\text{ ns}$, $V_{IH} = 2V$, $V_{IL} = 0.8V$ at $V^+ = 4.5V$, $V^- = -4.5V$

Note 6: Input rise and fall times must not exceed 5 μs .

Note 7: The output slew rate, rise time, and fall time are measured from the +3.0V to the -3.0V level on the output waveform.

Note 8: C_L include jig and probe capacitances.

Note 9: ESD Rating (HBM, 1.5 k Ω , 100 pF) $\geq 1.0\text{ kV}$.

Parameter Measure Information

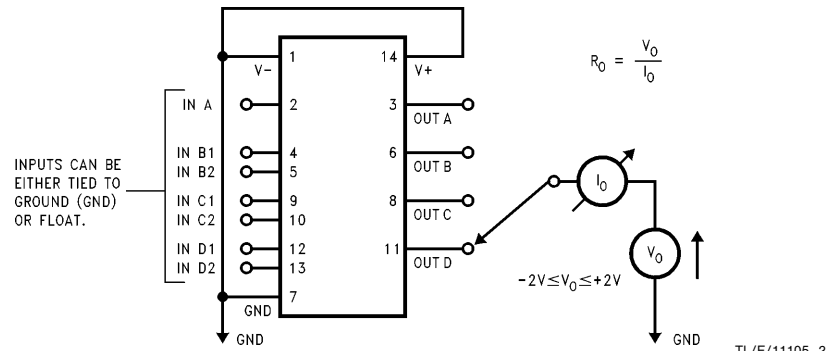


FIGURE 1. Output Resistance Test Circuit (Power-Off)

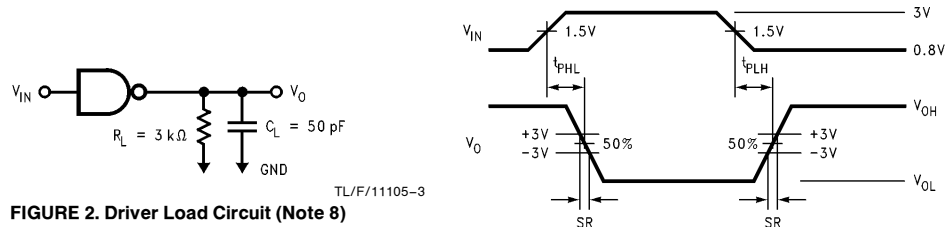


FIGURE 2. Driver Load Circuit (Note 8)

FIGURE 3. Driver Switching Waveform

Typical Application Information

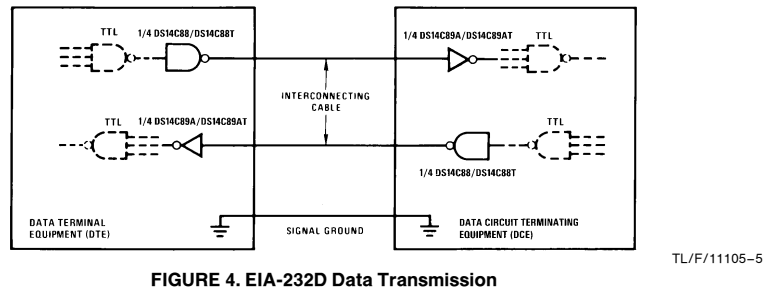
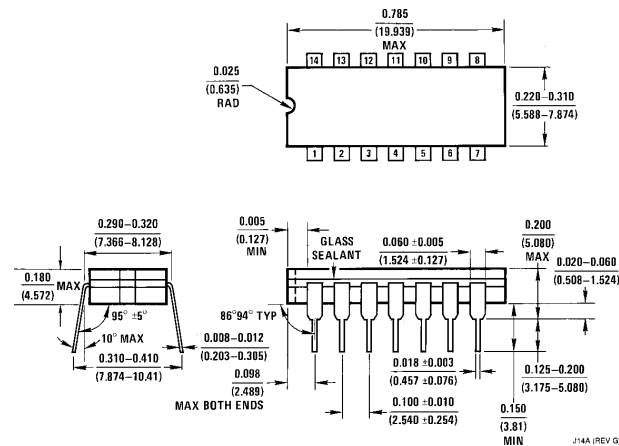
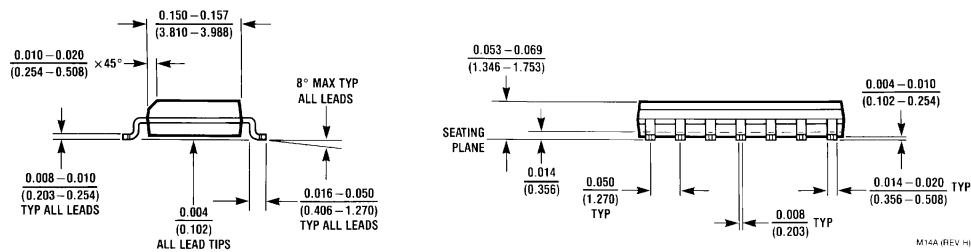
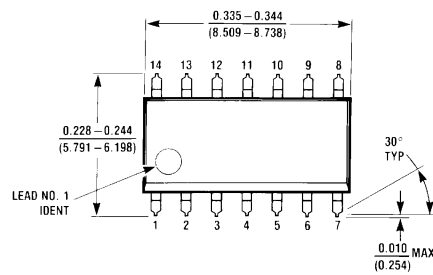


FIGURE 4. EIA-232D Data Transmission

Physical Dimensions inches (millimeters)

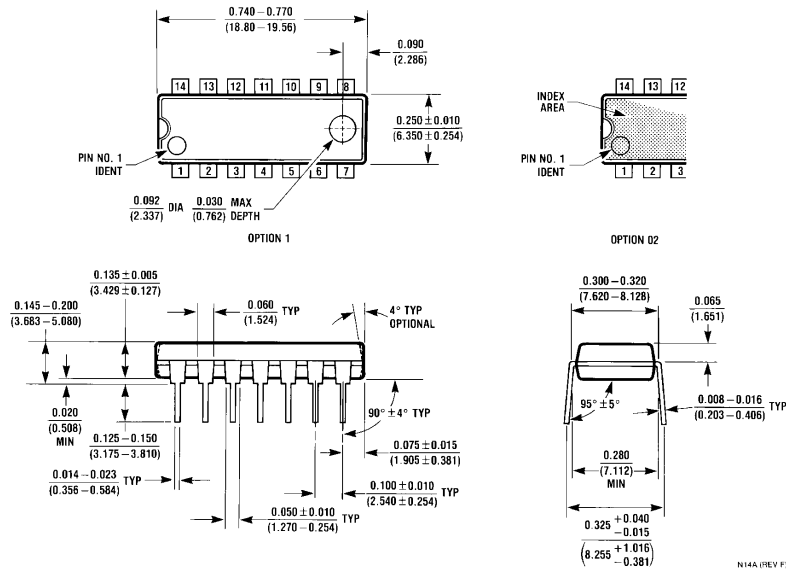


Order Number DS14C88TJ
NS Package Number J14A



Order Number DS14C88M or DS14C88TM
NS Package Number M14A

Physical Dimensions inches (millimeters) (Continued)



Order Number DS14C88N or DS14C88TN
NS Package Number N14A

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: (800) 272-9959
Fax: (800) 737-7018

<http://www.national.com>

National Semiconductor Europe

Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 180-530 85 85
English Tel: +49 (0) 180-532 78 32
Français Tel: +49 (0) 180-532 93 58
Italiano Tel: +49 (0) 180-534 16 80

National Semiconductor Hong Kong Ltd.

19th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.

Tel: 81-043-299-2308
Fax: 81-043-299-2408

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.